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U. S. FOREST SERVICE
Region 6

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A
BRIEF CHRONOLOGICAL HISTORY
OF THE
ACTION PROGRAM ON EUROPEAN PINE SHOOT MOTH
IN
WESTERN NORTH AMERICA

By

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INTRODUCTION

Infestations of the European pine shoot moth were discovered for the first time in the Northwest States in 1959. Later that year, many infestations were found in the Seattle, Washington area, indicating the shoot moth had been introduced several years earlier. Forest managers became alarmed because this exotic insect posed a serious threat to the valuable ponderosa pine forests in the Western States.

A combined eradication, quarantine, research and survey program was begun in 1959 under the auspices of the Northwest Forest Pest Action Council to combat the spread of this insect. Although infestations have spread in ornamental pines west of the Cascade mountains, no infestations have been found in natural pine stands east of the Cascades during the last 12 years. Hence, the potential destructiveness of the insect in natural pine forests in the West is yet unknown.

Recent studies by the Pacific Northwest Forest and Range Experiment Station indicate that this insect could become established in any pine stand. In many cases, it will likely behave much the same as a native insect. But, in some areas, such as southern and south-central Oregon, where the winters are mild and egg development occurs before the onset of hot, dry summers, it could become a persistent, destructive pest, particularly in plantations.

This report describes the cooperative efforts of many individuals and agencies to combat the European pine shoot moth in the Northwest.

1927

The European pine shoot moth, Rhyacionia buoliana (Schiff) was first observed and reported for western North America in a Victoria, British Columbia nursery in 1927. There were no further reports of this insect until 1938.

1938

Approximately 25 pines were reported infested with European pine shoot moth in a residential area of Vancouver, British Columbia. The extent of the outbreak indicated that the moth had been present in the area for at least several years.

1939Survey Results -

British Columbia surveys by Canada Department of Agriculture found 227 infested pines in Vancouver.

Control Operations -

In Vancouver, 88 pines were removed and destroyed. Infested shoots on 143 remaining pines were destroyed and the trees sprayed with arsenate of lead and nicotine sulphate.

1941Survey Results -

British Columbia control area was resurveyed and infested trees were found at two locations.

Control Operations -

Infested trees located during survey were either removed and destroyed or infested tips clipped and destroyed.

1959

Mr. Ed. Lewis, an alert gardener, was the first to find and report the European pine shoot moth in Washington. He found it on his ornamental pines at Bellevue, Washington, and reported it to the Foreign Plant Quarantine Division of the U. S. Department of Agriculture. It was identified but several months passed before Foresters learned of its discovery, at the annual meeting of the Northwest Forest Pest Action Council. At that time, the Council appointed a Pine Shoot Moth Committee and instructed it to assess the potential threat of the moth to forest resources of the Pacific Northwest; to recommend and initiate needed action on surveys, inspections, and quarantines; and determine control or eradication possibilities.

1960Survey Results -

The first of many annual cooperative surveys was made to detect the spread of the moth. These surveys involved the personnel of many State and Federal agencies, the timber industry, and other concerned public organizations. These groups are listed in the appendix.

Surveys were conducted by visual examining all buds on selected ornamental pines in the communities surveyed. Questionable insect infested shoots were removed and the insects reared and sent to the National Museum for identification if there was any possibility of their being shoot moth.

Washington communities known to be infested were Seattle, Spokane, Bellevue, Tacoma, Auburn, Fife and Shelton.

Oregon surveys found larvae of European pine shoot moth at a nursery in Portland on September 6, 1960, the first detection of the moth in Oregon. Approximately 150 Scotch and Japanese pines were infested all of which had been obtained in 1959 from nurseries at Snohomish and Seattle, Washington.

Control Operations -

In October, the Northwest Pest Action Council recommended eradication of the European pine shoot moth in Spokane and Shelton, Washington and at Portland, Oregon.

Research -

U. S. Forest Service and Agriculture Research Service started fumigation tests for European pine shoot moth eradication.

Western Washington Experiment Station began testing of insecticides against the moth.

U. S. Forest Service shipped ponderosa pine seedlings from Oregon to Michigan to test their susceptibility to moth damage.

Quarantines -

Efforts started to obtain uniform State quarantines for Oregon, Washington, Idaho and Montana.

Federal quarantine requested to prevent shipment of infested stock from Canada into noninfested areas.

1961Survey Results -

Washington surveys found previously unknown infestations at Bellingham, Raymond, Chehalis, Suquamish, and Mt. Vernon.

Oregon surveys found a shipment of 12,000 pines from Wisconsin to a Salem nursery infested. In May, a shipment of pines from a Pennsylvania nursery to a Eugene nursery were found infested. Infested pines were also located at three Portland nurseries and eight homes.

British Columbia reported the findings of infested pines at Kelowna, B. C. in the ponderosa pine region of the Okanagan Valley.

Control Operations -

Spokane Valley eradication project located and destroyed 429 infested pines plus 294 other pines growing within 200 feet of the infested pines.

Shipments of pines to Salem and Eugene nurseries that were infested were destroyed. Part of Salem shipment was reshipped to Salt Lake City where additional infested trees were found and destroyed.

Spot infestations at Raymond, Chehalis, Suquamish, and Mt. Vernon were destroyed.

All known infested pines at nurseries and homes in the Portland area were destroyed after the Oregon Legislature passed the enabling legislation.

Research -

U. S. Forest Service field tests on fumigation of individual trees completed. Fumigation tests on a commercial nursery completed; tests started on a Forest nursery.

Quarantines -

Oregon, Washington, California, Idaho, Hawaii, Montana, and Utah established interstate quarantines.

Washington established an intra-State quarantine forbidding the movement of untreated pines from Pierce, King, Mason, Spokane, and Whatcom Counties.

It was determined that the movement of pines into the United States from foreign countries was restricted by Federal regulations.

Federal - Foreign quarantine pertaining to nursery stock from Canada be enacted December 15, 1961.,

1962

Survey Results -

Washington surveys located European pine shoot moth on native lodgepole pine at Shelton. Small spot infestations found at Everett and Aberdeen. No European pine shoot moth found during survey of 1961 Spokane Valley Eradication Project area.

Oregon surveys found infested trees on three properties in southeast Portland.

British Columbia again reported the finding of the moth at Kelowna.

Control Operations -

Infested trees at Everett and Aberdeen destroyed.

Infested trees in Portland destroyed.

Local opposition to destruction of infested trees at Bellingham and Shelton developed. Some infested trees were voluntarily destroyed while other owners of infested trees indicated they would use a spray program as recommended by the Washington State Department of Natural Resources.

Washington instituted a tagging program of infested pines at nurseries and sales outlets.

Research -

U. S. Forest Service started a study of dispersal characteristics of the moth in western Washington.

Fumigated, baled and bundled nursery stock outplanted to evaluate phytotoxicity.

Successful method for fumigating ornamental pines to eradicate the shoot moth published.

Reports from Michigan indicated the moth accepted ponderosa pine as a host.

Insecticide test results from Western Washington Experiment Station using four applications of diazinon were advised by Washington State Department of Natural Resources for use at Bellingham and Shelton.

Quarantines -

Revised European pine shoot moth interstate quarantines to include methyl bromide treatments became effective during 1962 in Oregon, Washington, California, Montana and Idaho. Utah and Nevada established interstate quarantines.

Northwest Pest Action Council recommended that the Puget Sound area be set up as a European pine shoot moth containment zone pending future developments in the spread and control of the moth.

Miscellaneous -

Bill to reimburse owners for pines destroyed in Oregon during eradication projects introduced in State legislature. Bill not supported by nursery industry and died in Committee.

1963

Survey Results -

Washington surveys found 25 previously unknown infestations all located within the Puget Sound Containment Zone.

For the second year since the eradication project, no European pine shoot moths were found during the Spokane Valley survey.

Oregon surveys found eight infested trees at five homes and one nursery in Portland.

British Columbia surveys found European pine shoot moth in Victoria and greater Vancouver area. In the interior, the moth was found at Kelowna, Westbank, Summerland, and Penticton. The most significant record was the recovery of the moth from a native ponderosa pine at Summerland.

Control Operations -

All known infested trees in Portland area were destroyed. All infested shoots found in the interior of British Columbia were clipped and reared for research.

Research -

Dispersal study showed 253-foot flight by mated female moths.

Vacuum fumigation of bagged and baled trees found effective.

Study showed natural controls to be ineffective.

Economic impact study made of loss if European pine shoot moth were to move into the ponderosa pine region of the United States.

Quarantines -

Revised quarantine of the European pine shoot moth became effective in Utah on November 1, 1963.

Miscellaneous -

The approximate known direct costs for European pine shoot moth surveys and control projects for 1960 through 1963 was \$274,445. Indirect costs and expenditures by the Department of Agriculture in Oregon and Washington and by the U. S. Agriculture Research Service are unknown but substantial. Canadian costs are also unknown.

1964Survey Results -

Washington surveys found the infestations intensified within the Puget Sound Containment Zone, but no new finds outside this zone.

Oregon surveys found 14 infested trees on 11 properties in southeast Portland. No nurseries were found infested.

British Columbia surveys found infestations present in Okanagan Valley and in the Lower Mainland.

Control Operations -

All 14 known infested trees in the Portland area were removed and destroyed.

Research -

The Northwest Forest Pest Action Council on May 27, 1964 recommended that an accelerated program of research be undertaken to develop an acceptable method of eradication of the shoot moth from western North America.

Bud characteristics of ponderosa pine that might affect shoot moth attack were identified. Pinyon pine planted in infested area in study of host preference.

1965Survey Results -

Washington surveys located an infestation at two ornamental pine plantations and on adjacent pines at Tumwater.

Some infested trees from these plantations had been shipped to central Washington.

Oregon surveys found infested trees being planted along a Portland freeway. Trees were traced to a nursery near Olympia, Washington.

British Columbia surveys found the moth to be widely distributed in greater Victoria and greater Vancouver and in the Lower Fraser Valley as far east as Chilliwack. In the interior British Columbia survey, three infestations were located and traced to trees imported from Holland in 1964 and 1965. Infested areas were Oliver, Kelowna, and Kamloops.

Control Operations -

Twenty-two infested trees shipped from Tumwater were traced to central Washington and destroyed. Three trees shipped to the Omak area could not be located. Entire shipment of pines used at Portland freeway plantings were destroyed.

Research -

Studies on evaluation of irradiation for the sterile-male technique of biological control and development of an artificial diet for mass rearing of the moth were started at Washington State University under Forest Service grants.

Mating and sex-attraction studies commenced.

Emergence pattern studied on mugho pine.

Outplantings of ponderosa from Oregon in Michigan evaluated for relative susceptibility to European pine shoot moth attack.

Larvae found to successfully overwinter at Vernon, B. C. on native ponderosa pine.

An economic evaluation of potential European pine shoot moth damage in the ponderosa pine region was published. 1/ It was estimated that from four to nearly 23 million acres of pine-type could be seriously affected with the possible loss of from 651 million to 4,375 million board feet of allowable timber cut per year.

Quarantines -

Removal of the quarantine from Spokane, Washington, was discussed. Removal was suggested after three years of negative surveys. This has occurred.

It was agreed by the Northwest Pest Action Council that part of the Snohomish County and all of Kitsap County should be included in the Washington intra-State quarantine.

Complaints have been received that pines are being shipped into Washington without certification as required in the quarantine.

New boundaries were set for the containment zone in Washington. This zone was essentially from the crest of the Cascades on the east to the ocean on the west, Canada on the north and southward to Tacoma.

1/Flora, D.F. 1965. Economic evaluation of potential European pine shoot moth damage in the ponderosa pine region. U. S. Forest Service. PNW Forest and Range Experiment Station. Res. note PNW 22.

1966Survey Results -

Washington surveys found three spot infestations outside the Puget Sound Containment Zone. These were at Longview, Port Angeles, and Prosser.

A survey was conducted to estimate the density of the shoot moth on Mercer Island.

Oregon surveys found one nursery infested in northeast Portland. Residential survey negative first time since 1961.

California reported the first finding of the European pine shoot moth at Berkeley in a shipment of trees from Portland.

British Columbia reported infestations in the Lower Fraser Valley and at Westbank in the Okanagan Valley.

Control Operations -

Infested trees destroyed at a nursery in Portland in ornamental plantings at Berkeley, California. ^{AND}
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Research -

An artificial diet for European pine shoot moth developed at Washington State University.

An improved technique for mating European pine shoot moth in the laboratory developed.

Response of European pine shoot moth males to female sex attractant was almost 100 yards in test.

Additives to extend life of sex attractants extracts were developed.

Daily emergence of adult moths by pine species and sex ratios studied.

Quarantines -

Violations of state quarantines were found. In 1964, pine trees were taken by private vehicle from a Seattle nursery to a Portland nursery in violation of the quarantine. Pines shipped from this nursery to Berkeley, California, in the fall of 1965 were found to be infested in the spring of 1966.

1967

Survey Results -

Washington surveys found infestations at Kennewick, College Place, and Walla Walla. These were the first infestations found in eastern Washington ponderosa pine area since the eradication project in the Spokane Valley in 1961. Additional Christmas tree plantations were found infested in western Washington near Olympia.

Traps baited with a natural sex pheromone first used in European pine shoot moth surveys. ✕

Oregon surveys found 14 infested trees in west Portland at three residential properties and one nursery. Of major importance was the finding of large scale infestations in Umatilla County in eastern Oregon. Large numbers of infested trees were found at Hermiston, Umatilla, McNary Dam, and the Port of Umatilla. It was estimated by stem analysis that this infestation had been present from six to 12 years. ✕

Control Operations -

All known infested trees at Longview and Port Angeles in Washington were fumigated in the spring of 1967. Some of the infested pines in west Portland were fumigated, the remainder were destroyed. Outbreaks in eastern Oregon and Washington were found too late in 1967 for control operations to be undertaken that year.

Research -

Characteristics to distinguish between mated and unmated European pine shoot moth females identified.

Studies were completed on the emergence patterns of the moth.

Bud size determined as limiting factor on European pine shoot moth use of pinyon pine as a host.

Use of traps baited with sex pheromone successful in areas where visual surveys were netagive.

Research to develop sterilizing technique continued.

Quarantines -

Outbreak in west Portland determined to have developed from pine brought into Oregon in violation of European pine shoot moth quarantine.

As of September 1, 1967, the Canadian Department of Agriculture regulations required all Pinus species moved into British Columbia to be fumigated with methyl bromide.

Program -

The European pine shoot moth eradication program was re-evaluated by an ad hoc committee of the Northwest Forest Pest Action Council and eradication of the moth from western North America was now considered impractical.

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1968Survey Results

Washington surveys located infested pines in College Place and Kennewick after trees previously found infested had been destroyed or sprayed before the 1968 moth flight.

Oregon surveys during the spring and fall found nearly 600 pines infested in Umatilla County. This number included the trees found in late 1967.

Control Operations -

A total of 92 infested pines were destroyed at College Place and Walla Walla in eastern Washington.

At Kennewick, Washington, 311 pines were sprayed with Sevin at the rate of one pound active in 100 gallons of water. Four applications were made at two-week intervals.

At Hermiston, Oregon, 1,217 trees were sprayed one time, pre-flight, with Sevin, four pounds and Kelthane, one pound per 100 gallons of water. At the Port of Umatilla, 82 pines were sprayed with Cygon 267 at a rate of three pints per 100 gallons water.

An effort was made to reduce an isolated population of European pine shoot moth by trapping adult males using traps baited with the moth's female sex pheromone.

In a nursery near Tigard, Oregon where one questionable pupa was found, all pines were sprayed.

Research -

Dispersal studies of tagged moths were started on Whidbey Island.

A cooperative effort was launched to collect female moths for a study of the chemical fractions of the sex attractant.

A study was started on the survival and potential damage to ponderosa pine in a natural stand at Pringle Falls, Oregon.

A crash program on screening of systemic insecticides for European pine shoot moth control was started at Washington State University at Puyallup.

The Oregon Graduate Center proposed a chemical investigation of sex attractant as the first step in the production of synthetic sex attractant.

Location and structure of the pheromone gland of female European pine shoot moth described.

Quarantines -

Intra-province shipment of pines permitted April 1 to May 15 in British Columbia, if they have been dipped in a 25 percent DDT solution.

1969

Survey Results -

Washington surveys located new infestations at Vancouver and Grandview. Additional infested pines were found in the control areas at College Place, Kennewick, and Walla Walla. One Christmas tree plantation with approximately 120 infested trees was found near Centralia.

Oregon surveys found five infested trees at a residence in northwest Portland. Eighty infested trees were found in a large infested area in southwest Portland. Five additional infested trees found late in year in southwest Portland after control operation was completed.

Control Operations -

Infested trees at College Place and Walla Walla in Washington destroyed before moth flight.

Infested trees in Umatilla County sprayed for second year. Four spray applications of Sevin at a rate of one pound per 100 gallons of water was applied to 1,950 trees.

Infested trees at a northwest Portland residence were destroyed.

In southwest Portland, 900 trees were sprayed with four applications of Sevin at the same dosage used on the Umatilla project.

Research -

Sterile-male control approach tested on small scale in Seattle.

Survival and host damage tests continued on natural native pine stand at Pringle Falls.

Work started on the identification and syntheses of European pine shoot moth sex attractant at Oregon Graduate Center.

Tests by Washington State University of several systemic insecticides for control of the moth show promise.

Study of parasite release as a knock-down method in integrated control tested at McNary Dam.

Quarantines -

Infested nursery stock from within the containment zone in Washington shipped in violation of quarantines. Shipment was intercepted and destroyed in eastern Oregon.

1970Survey Results -

Washington surveys found the infestations in Vancouver and Grandview spreading. Infestations in the areas at Kennewick, Walla Walla, and College Place where control was attempted were very low.

Oregon surveys were negative in control areas in Portland. Infestations in Umatilla County were at a low level following 1968 and 1969 spray projects. One new infestation was found in a commercial nursery near Canby.

Control Operations -

Infested pines in a nursery at Canby, Oregon were destroyed and movement of remaining pines restricted.

Research -

Research on the identification and syntheses of the moth's sex attractant continued at the Oregon Graduate Center.

Tests were run using various synthetic sex attractants used on other insects. One, a cabbage looper pheromone, available commercially, was found to arrest the European pine shoot moth's attraction to the natural female pheromone. This may prove a useful tool in an integrated control program.

Tests by Washington State University show that control approaching 100 percent can be obtained with Guthion.

A proposal for tests involving free release of the moth at an isolated pine stand in central Oregon was rejected, after a series of meetings. It was felt the insect might escape and become established in other pine stands.

Quarantines -

One shipment of pines from within the quarantined Puget Sound Containment Zone was intercepted at Spokane and destroyed.

1971Survey Results -

Washington surveys found no infested trees outside the Puget Sound Area Containment Zone except the known infested areas at Vancouver, Kennewick, Grandview, and Prosser. No infested trees were found at the former eradication areas at Spokane, Walla Walla, and College Place. *

Oregon surveys found the shoot moth population at low levels in the control areas in Umatilla County. One infested pine was found in Pendleton.

Control Operations -

No control operations were undertaken in Washington during 1971.

In Oregon an infested tree at Pendleton was destroyed and adjacent pines sprayed.

Research -

During the spring, before moth flight, a quarter-million pine shoots infested with European pine shoot moth were collected in the Seattle area. From these shoots, 40 thousand female moths were reared and processed to obtain sex attractant extract. This extract will be used by the Oregon Graduate Center for chemical analysis to identify the sex pheromone.

Research on the moth at the Oregon Graduate Center was curtailed during the year due to the movement of the Center into new quarters.

Canadians started research on the survival of the moth on 1-0 lodgepole seedlings and cut pine Christmas trees.

Quarantines -

It was recommended to the Western Plant Board at its annual conference that interstate quarantines be continued but modified to permit movement of pine stock with inspection and approved sanitation procedures rather than stringent fumigation requirements.

APPENDIX

The following is a list of the agencies, organizations, and companies which cooperated with the Northwest Forest Pest Action Council in the action program against the European pine shoot moth:

Region Six, U. S. Forest Service, Portland, Oregon

Northwest Forest and Range Experiment Station, U.S.F.S., Portland, Oregon.

North Central States Experiment Station, U.S.F.S., St. Paul, Minnesota

Plant Pest Control Division, A.R.S., U.S.D.A., Sacramento, California

Plant Protection and Quarantine Programs, Animal and Plant Health Service, Pullman, Washington

Washington State Department of Natural Resources, Olympia, Washington

Washington State Department of Agriculture, Olympia, Washington

Western Washington Research and Extension Center, Puyallup, Washington

Washington State University, Pullman, Washington

University of Washington, Seattle, Washington

Washington Nurseryman Association, Seattle, Washington

Oregon State Department of Forestry, Salem, Oregon

Oregon State Department of Agriculture, Salem, Oregon

Oregon State University and Experiment Station, Corvallis, Oregon

Oregon Graduate Center, Beaverton, Oregon

Oregon Nurserymens Association, Portland. Oregon

Department of the Navy, Northwest Division, Seattle, Washington

Corps of Engineers, Walla Walla District, McNary Dam

Canadian Forestry Service, Department of Environment, Victoria, B.C.

APPENDIX

California State Department of Agriculture, Sacramento, California

Washington State Rehabilitation Center, Seattle, Washington

Mike Webster Nursery, Tumwater, Washington

Gruly Industrial Nursery, Olympia, Washington

Bonnybrook Nursery, Bothell, Washington

Sandpoint Golf and Country Club, Seattle, Washington

Childrens' Orthopedic Hospital, Seattle, Washington

Seattle Parks Branch, Seattle, Washington

Dow Chemical Co., Seattle, Washington

Ruddy Chemical Co., Seattle, Washington

U. S. National Museum, Washington, D. C.